

# PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

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in its capacity as elected Office

Date of mailing (day/month/year)

15 January 1998 (15.01.98)

International application No.

PCT/GB97/01513

Applicant's or agent's file reference

P31659WO

International filing date (day/month/year)

04 June 1997 (04.06.97)

Priority date (day/month/year)

04 June 1996 (04.06.96)

Applicant

KENNY, Paul, Martin

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

16 December 1997 (16.12.97)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was



was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Beatriz Morariu

Telephone No.: (41-22) 338.83.38

# PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

LUNT, Mark, G., F.  
Dibb Lupton Alsop  
Fountain Precinct  
Balm Green  
Sheffield S1 1RZ  
ROYAUME-UNI

<b>Date of mailing</b> (day/month/year) 14 October 1998 (14.10.98)	<b>IMPORTANT NOTIFICATION</b>
<b>Applicant's or agent's file reference</b> P31659WO	
<b>International application No.</b> PCT/GB97/01513	<b>International filing date</b> (day/month/year) 04 June 1997 (04.06.97)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input checked="" type="checkbox"/> the inventor	<input type="checkbox"/> the agent <input type="checkbox"/> the common representative
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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input checked="" type="checkbox"/> the person	<input type="checkbox"/> the name	<input checked="" type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence
Name and Address KONSTANDELOS, John 6 Stewart Street Doncaster DN1 1RT United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
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3. Further observations, if necessary: <b>The person identified in Box 2 has been added to the record as applicant/inventor (for the US only). The applicant's Nationality and Residence has been entered in accordance with the telephone conversation between the agent and the IB on 12 October 1998.</b>		
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<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer Nicola Wolff</p> <p>Telephone No.: (41-22) 338.83.38</p>
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Name and Address WHITEHEAD, Mark 32 Maple Avenue Maltby Rotherham S66 8EL United Kingdom	State of Nationality GB	State of Residence GB
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3. Further observations, if necessary: <b>The person identified in Box 2 has been added to the record as applicant/inventor (for the US only). The applicant's Nationality and Residence has been entered in accordance with the telephone conversation between the agent and the IB on 12 October 1998.</b>		
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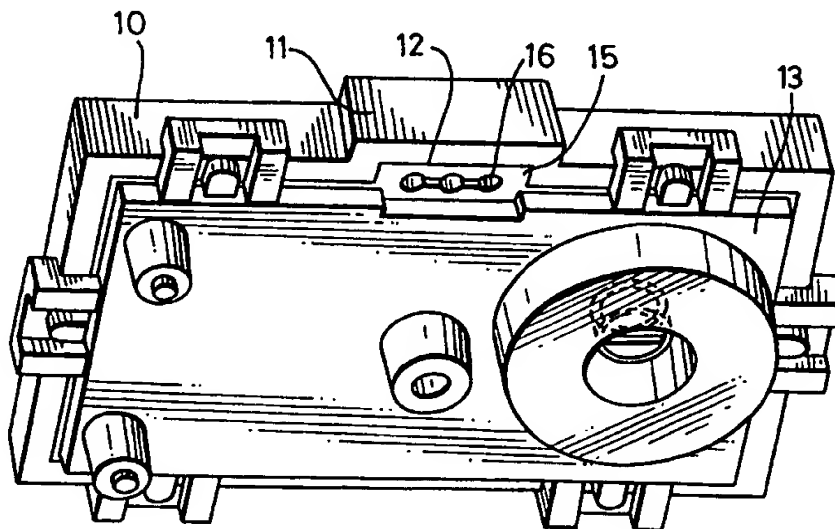
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>H05K 9/00</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 97/47169</b> <b>(43) International Publication Date:</b> 11 December 1997 (11.12.97)
<b>(21) International Application Number:</b> PCT/GB97/01513 <b>(22) International Filing Date:</b> 4 June 1997 (04.06.97)  <b>(30) Priority Data:</b> 9611633.0                      4 June 1996 (04.06.96)                      GB  <b>(71) Applicant (for all designated States except US):</b> PYRONIX LIMITED [GB/GB]; Pyronix House, Braithwell Way, Hellaby, Rotherham S66 8QY (GB).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> KENNY, Paul, Martin [GB/GB]; Lodge Farmhouse, 48 Main Street, North Anston, Sheffield S25 4BD (GB).  <b>(74) Agent:</b> LUNT, Mark, G., F.; Dibb Lupton Alsop, Fountain Precinct, Balm Green, Sheffield S1 1RZ (GB).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, <b>(US)</b> UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: ELECTRONIC DEVICE WITH A SHIELDING ENCLOSURE



## (57) Abstract

The invention relates to electronic circuit devices, and more particularly to the suppression of spurious unwanted emissions from electronic circuit components and discontinuities. The device comprises an electronic circuit board having components and discontinuities capable of radiating unwanted emissions, the circuit having at least one connection means to which an external connection is to be made, the connection means may extend from a surface or periphery of the board, the device also comprising an enclosure for the board, the enclosure having a first main portion and a second frame portion, the board being mounted therebetween, the first and second portions being adapted to provide a chamber about the upstanding connection means and/or having an aperture sized and shaped to provide a close fit about a cable or the like to be connected to the connection means, whereby unwanted emissions from the electronic components and/or discontinuities are substantially prevented from leaving the enclosure via a region adjacent to the connection means.

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## ELECTRONIC DEVICE WITH A SHIELDING ENCLOSURE

This invention relates to an electronic device having an enclosures for electronic circuits for the suppression of spurious unwanted emissions such as harmonic emissions from electronic circuit components and discontinuities and, more particularly, to enclosures for suppressing or substantially reducing the emission of unwanted electromagnetic radiation whilst concurrently allowing the emission of wanted electromagnetic radiation.

Electronic circuits, and in particular microwave circuits, are used in a variety of applications, for example, they are commonly employed in motion detection units for detecting a moving person or object by means of a Doppler frequency shift. A motion detector is arranged to emit electromagnetic radiation at particular frequencies via a given aperture, that is to say, a motion detector is an intentional radiator of electromagnetic radiation.

All electronic circuits generate and radiate spurious emissions which can exceed a maximum level set by current EMC regulations. In order to conform to current EMC standards, any spurious emissions from circuit components and discontinuities having frequencies which fall outside an allocated frequency band must be

suppressed. Circuit elements or devices, for example, dielectric resonator oscillators and mixers, which are typically used in motion detection units, can generate significant levels of harmonic emissions. These  
5 emissions can leak out through the mechanical joints between, for example, the enclosure and the circuit board of the microwave motion detection unit.

Circuits are therefore often housed in enclosures which  
10 act as shields to prevent unwanted emissions radiating into free space.

These enclosures are usually made of a conducting material such as aluminium or brass, or metal coated  
15 plastic. A conducting mesh can also be used providing that the apertures in the mesh are small enough to prevent the emissions from escaping. Enclosures can also be made of an absorbing material to absorb the emissions. Alternatively, a plastic material loaded with metal  
20 filings or granules can be used to confine emissions to the enclosure.

High frequency emissions are more difficult to screen because they can escape through small gaps in the  
25 enclosure, for example, where the cover and the main enclosure joins, or at cable entry points.

Figure 1 shows a perspective view of a known motion detector 1. A frame 5 is used to clamp a printed circuit board 2 to the main enclosure 6. The circuit side of the printed circuit board faces inwards into the enclosure.

5 The conducting groundplane of the printed circuit board is outward facing. A printed antenna is attached to the groundplane and is coupled to the circuit via a slot in the groundplane. Printed circuit board 2 has a solder tab 3. In order to accommodate solder tab 3, a slot is

10 cut into a side wall of frame 5 in order to allow the tab to pass through. A ribbon cable 9 is soldered to tab 3.

The gap between the circuit board 2 and one side of the slot in frame 5 is sealed by means of gasket 7 to

15 block emissions. The gap between the circuit board and the other side of the slot has been minimised, but some clearance, gap 8, is necessary to prevent lines or components on the printed circuit board from being short circuited by either frame 5 or main enclosure 6. Gap 8

20 provides a path for unwanted emissions to radiate into free space.

In the present invention, an improved method of suppressing unwanted radiated emissions, such as

25 microwave or RF emissions, from an electronic circuit such as a microwave circuit and/or antenna circuit is provided wherein:



an enclosure for the circuit having a chamber for suppressing various emissions is provided about connection means extending from a circuit board, for example, a solder tab; and/or

- 5        an enclosure for the circuit is provided having an aperture sized and shaped to be a close fit about an item to be connected to the circuit board such as a cable.

In a first aspect, therefore, the present invention  
10 provides an electronic device comprising an enclosure for a circuit board bearing elements, for example, components and/or discontinuities, capable of radiating unwanted emissions, the circuit having at least one connection means extending from a surface or a periphery of the  
15 board to which an external connection is to be made, the enclosure comprising only a first main portion and a second frame portion, the board being mounted there between, preferably, with an outwardly facing circuit groundplane outward facing;

- 20        at least one of either of the first or second portions comprising means for substantially surrounding the extending connection means;

whereby unwanted emissions generated by the electronic circuit are substantially prevented from  
25 leaving the enclosure via a region adjacent to the connection means.

In a preferred embodiment, the first and second portions are adapted to provide a chamber about the connection means.

5        Preferably, the second frame portion comprises an extension sized and shaped to substantially surround the upstanding connection means. Preferably, the extension is sized and shaped to clear the upstanding connection means. The extension may comprise an outwardly extending  
10    recess in a peripheral wall of the second frame portion. Preferably, the peripheral wall of the frame, including the recess, is continuous, that is, the peripheral wall and the recess are formed in an integral manner. The frame may comprise electromagnetic radiation absorbing  
15    and/or reflecting material. Preferably, the frame is conducting.

In a further preferred embodiment, the first main portion comprises a projection extending from a wall of  
20    the main portion. Preferably, the projection on the first main portion and the extension on the second frame portion are sized and shaped to form an electromagnetically sealed chamber about the extending connection means.

25

Preferably, the projection of the first main portion comprises one or more apertures through which a connection to the connection means can be made.

Preferably, the aperture is sized and shaped to accommodate a cable, antenna feed, power source or the like. The cable may be a ribbon cable. The connection means may be adapted for connection to the cable,  
5 antenna, power source or the like. The connection means may be a solder tab.

Preferably, the first main portion comprises electromagnetic radiation absorbing and/or reflecting  
10 material. Preferably, the first main portion is conducting.

Preferably, the enclosure for the microwave circuit board is conductive and can be constructed in metal, such  
15 as brass or aluminium, or be of a metal coated plastic. The enclosure could comprise a microwave absorbing material. A plastic material loaded with metal filings or granules could be used.

20 The enclosure can comprise an injection moulded cover, for example, of a metal loaded plastics material, the cover having an edge region conforming substantially to the edge of the microwave circuit board and being a close fit therewith. Any gaps between the peripheral  
25 edge of the microwave circuit board and the peripheral edge of the enclosure are minimised.

Microwave circuit components capable of radiating unwanted emissions include, for example, dielectric resonator oscillators, mixers and like components. Discontinuities in the printed or etched microwave circuit components, such as microstrip lines, can also  
5 give rise to unwanted emissions.

In a further preferred embodiment, the circuit board is a printed circuit board.

10

In a further preferred embodiment, the device is a microwave circuit device, preferably, an intrusion detection device, for example, a motion detection device.

15 A preferred embodiment of the invention will be described now, by way of example only, with reference to the following figures.

Figure 2 illustrates a perspective view of a frame  
20 for an electronic circuit device having an extension, seen from above.

Figure 3 illustrates the frame of figure 2, seen from below.

25

Figure 4 illustrates a perspective view of printed circuit boards, seen from above.

Figure 5 illustrates a perspective view of a main enclosure for an electronic circuit, seen from above.

Figure 6 illustrates a perspective view of an electronic circuit, in this case a motion detector assembly, when fully assembled, seen from below.

Referring to figure 2, there is shown a frame 10 or first portion of an enclosure made of a electrically conductive material and having a continuous or integrally formed outer wall 10a. The enclosure is arranged to accommodate a circuit board bearing elements capable of generating undesired electromagnetic radiation. The outer wall 10a comprises an extension 11 for housing a circuit element which extends from said circuit board.

Referring now to figure 3, there is shown schematically a perspective view of the first portion view from the below. It can be seen that extension 11 comprises a recess 12 in order to accommodate an extending connection means, for example, solder tabs or the like (not shown).

Figure 4 depicts a printed circuit board assembly 2 comprising a microwave circuit board 2c and having connection means in the form of a solder tab 8 extending outwardly from the periphery of the microwave circuit board 2c. An antenna circuit board 2a having an antenna

printed thereon is also provided. The antenna circuit board and the microwave circuit board face in mutually opposite directions. When the printed circuit board assembly is mounted within the enclosure, the microwave circuit board 2c is inwardly directed whereas the antenna circuit board 2a is outwardly directed. The printed antenna is mounted on the back of printed circuit board 2c. A groundplane is disposed between the microwave circuit board 2c and the antenna circuit board 2a.

10

A solder tab 8 is provided to allow external connections to the microwave circuit board 2c, antenna circuit board 2a and the ground plane 2b, such external connection being used for the provision of signal cables, power cables and earth connection. The recess 12 in outer wall 10a of frame 10 is sized and shaped to substantially surround tab 8 without, in this preferred embodiment, coming into contact therewith. The lack of contact between the wall of the recess 12 and the solder tabs avoids short circuits between any circuit elements associated with or carried by the extending connection means. The outer wall 10a is continuous ie no slots, or other gaps, are provided in the frame wall which could result in unwanted leakage of emissions. Preferably, the outer wall is integrally formed by, for example, injection moulding.

25

With reference to figure 5, a main or second part 13 of the enclosure is shown. Printed circuit board assembly 2 is mountable within the space 14 of the enclosure 13.

5

An outwardly extending projection 15 is provided in the wall of the second part of the enclosure 13 at a location corresponding to the location of solder tab 8 on circuit board 2. Projection 15 comprises at least one  
10 aperture 16 arranged to snugly receive the cables for the external connections to the solder tab 8. Typically, the external connections are provided by using a ribbon cable. When assembled, solder tab 8 is positioned adjacent upper surface 17 of projection 15.

15

Referring now to figure 6 there is shown an assembled electronic device, for example, a motion detector, comprising the frame 10 and main enclosure portion 13. The printed circuit board assembly 2 is  
20 housed within the chamber formed by the frame and the assembly. The frame 10, main enclosure portion 13 and printed circuit board 2 have been aligned prior to assembly so that projection 15, extension 11 and solder tab 8 are all substantially aligned to thereby prevent  
25 the emission of unwanted radiation. As can be seen from figure 6, projection 15 snugly cooperates with the open aspect of recess 12 to so to form an electromagnetically sealed extension chamber within which solder tab 8 is

located to prevent emission of em-radiation from within the chamber. The only access to solder tab 8 is via aperture 16 through which a ribbon cable, for example, can be located. The cable is a close, push fit within  
5 the spaced circular holes which form aperture 16. The holes can be cylindrical or tapered to ease insertion of the cable.

The printed circuit board 2 with groundplane facing  
10 outwards, is mounted in the main enclosure 13 and held in place by frame 10. The frame and the main enclosure in the vicinity of the solder tab, ie projection 15 and extension 11, are a close fit to substantially obviate or reduce emissions escaping through the joint. The solder  
15 tab is now completely enclosed in a chamber formed by the frame and the main enclosure.

Although there is still a path through the cable insulator, ie the outer part of the ribbon cable, by  
20 which emissions can escape, the actual gap between the cable conductor, ie the central part of the cable, and the enclosure is as a consequence of the snug fit smaller and hence unwanted emissions are significantly reduced.

25 It will be apparent to those skilled in the art from the information contained herein that the principle of shaping the aperture in the wall of an enclosure to minimise gaps through which cables pass, can be applied



to cables with different cross sections or to items other than cables, such as components, antennas feeds and the like.

5        It will also be apparent to those skilled in the art that the preferred assembly is one in which the printed circuit board assembly is mounted within the enclosure with the component side facing inwards. The printed circuit board assembly is held in place by a frame. The  
10 outer surface of the printed circuit comprises a groundplane so that the component side of the circuit is completely surrounded and emissions are confined to the enclosure. A printed antenna is attached to the back of the groundplane and coupling between circuits is achieved  
15 via a slot in the groundplane.

However, the invention can be applied to other mechanical arrangements. For example, the printed circuit board can be completely encased within a chamber  
20 consisting of a main enclosure and a separate cover. The assembly would not then be reliant on the circuit groundplane to act as a screen. Access to the circuit would be by a method similar to that used with the frame.

25        Indeed, the principle of providing an enclosure having a chamber, for absorbing, reflecting and/or otherwise suppressing emissions, about a connection means extending from a circuit board and/or providing an

aperture sized and shaped to be a close fit about an item to be connected to the circuit board can be applied to other mechanical arrangements. All such alternative embodiments are intended to be within the scope of this application.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

20

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiments. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any  
5 accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. An electronic device comprising: an enclosure for housing an electronic circuit board, the enclosure having:  
5 a chamber for suppressing emission of electromagnetic radiation from a connection means extending from the board.
- 10 2. An electronic device as claimed in claim 1, further comprising:  
an aperture sized and shaped to be a snug fit about an item to be connected to the circuit board.
- 15 3. An electronic device as claimed in either of claims 1 of 2, wherein the enclosure for the circuit board comprises a first main enclosure portion and a second frame portion, the board being mountable with groundplane facing outwards there between;  
20 the first main enclosure portion and the second frame portion being formed so as to provide a chamber about the extending connection means to thereby substantially suppress unwanted emissions from the circuit elements mounted on said board  
25
- 4 An electronic circuit device as claimed in any preceding claim, wherein said aperture is formed

within at least one of either of said main enclosure portion and said frame portion.

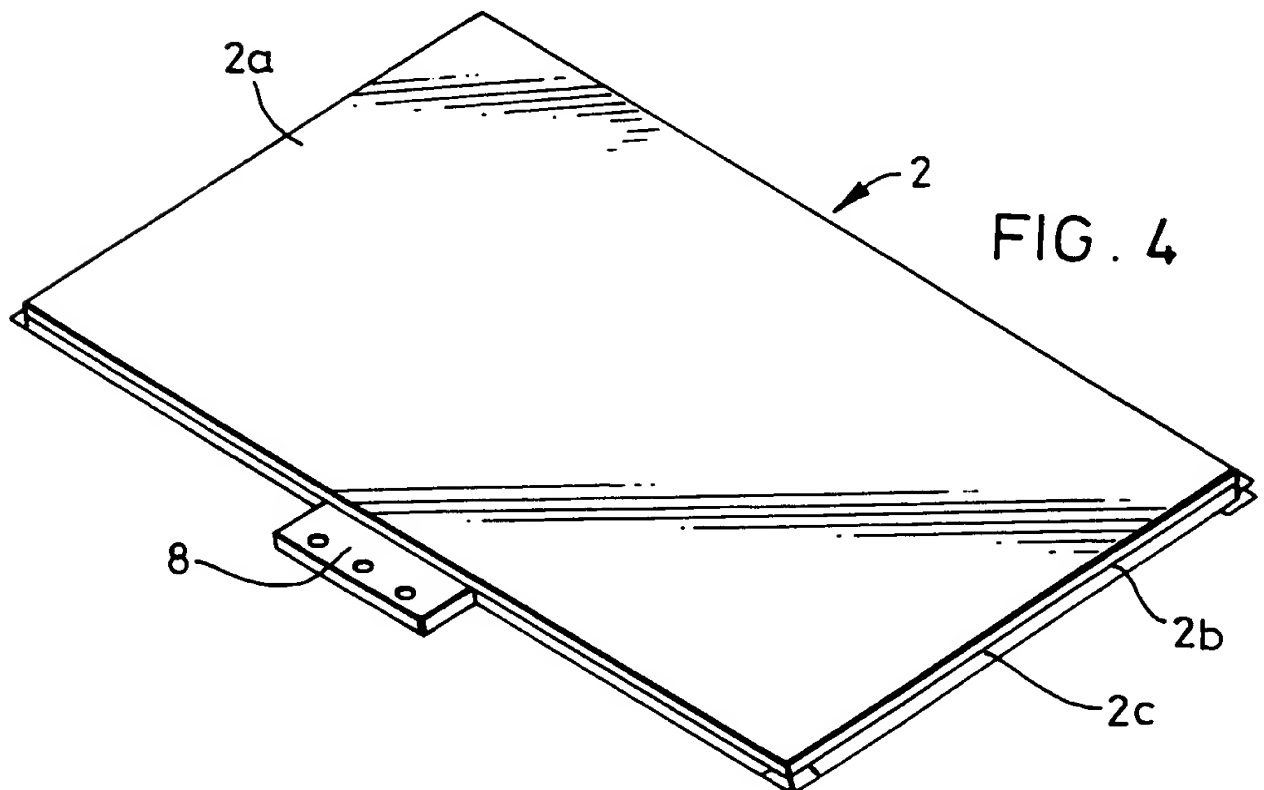
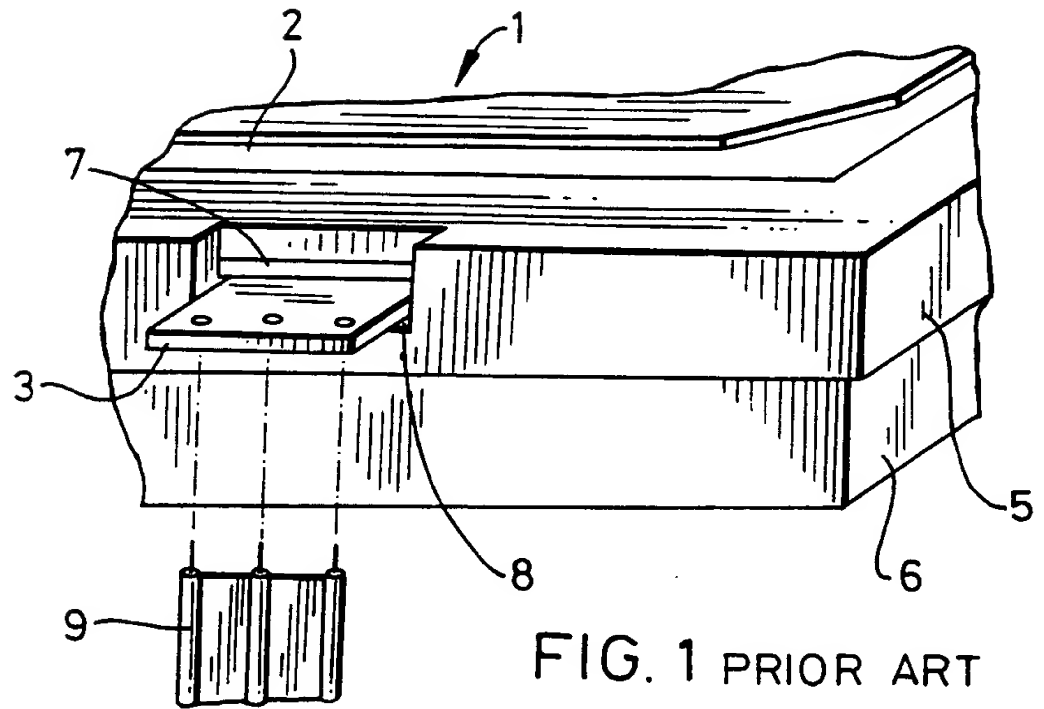
- 5 5. An electronic device as claimed in any preceding claim, wherein the second frame portion comprises an extension sized and shaped to substantially surround the extending connection means.
- 10 6. An electronic device as claimed in any preceding claim, wherein at least one of either the frame portion and the main enclosure portion is electromagnetically continuous and is preferably integrally formed.
- 15 7. An electronic device as claimed in any preceding claim, wherein at least one of either the frame portion and the main enclosure portion comprise electromagnetic radiation absorbent and/or reflective material.
- 20 8. An electronic circuit device according to any preceding claim, wherein the frame portion is conductive.
- 25 9. An electronic device as claimed in any preceding claim, wherein the first main enclosure portion comprises a projection having one or more apertures

through which connection to the connection means can be made.

10. An electronic circuit device as claimed in any preceding claim, wherein the first main enclosure portion is conductive.
11. An electronic device as claimed in any preceding claim, wherein the connection means is adapted for connection to a cable, power source, antenna feed or the like.
12. An electronic device as claimed in any preceding claims, wherein the connection means comprises at least one solder tab.
13. An electronic device as claimed in any preceding claim, wherein the electronic circuit board is operable at least one of either RF or microwave frequencies.
14. A intruder detection device, preferable a motion detector, for intentionally radiating electromagnetic radiation of a selectable frequency, said motion detector comprising an electronic device according to any preceding claim for suppressing frequencies other than said selectable frequency.

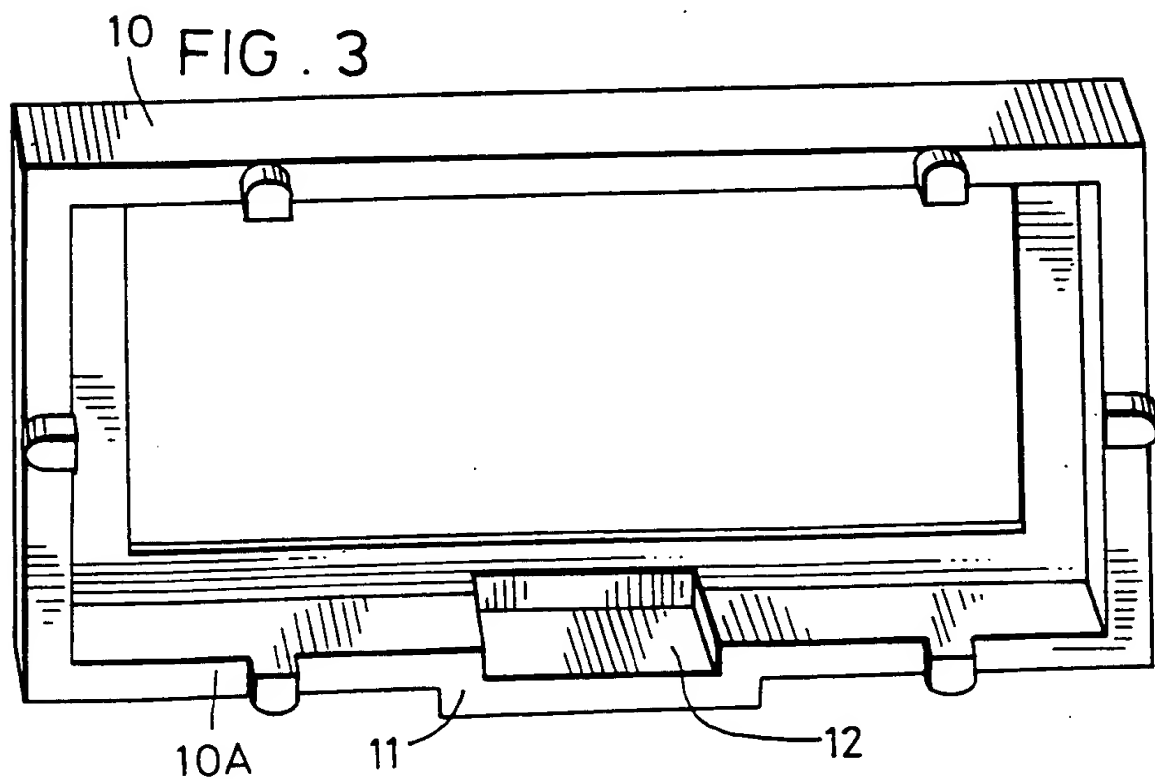
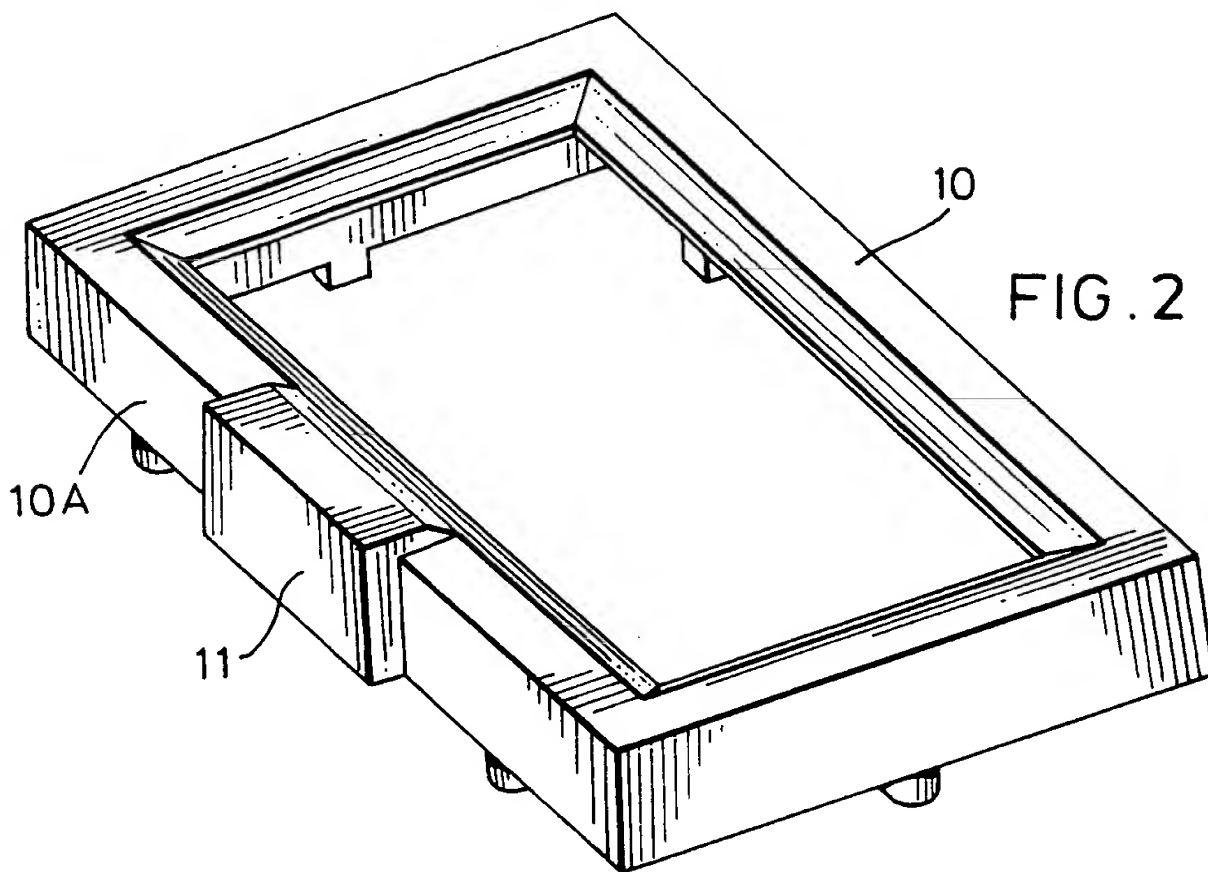
15. An electronic device substantially as described herein with reference to and/or as illustrated in figures 2 to 6.
- 5 16. A intrusion detection device comprising an electronic device as claimed in claim 15.

1 / 3

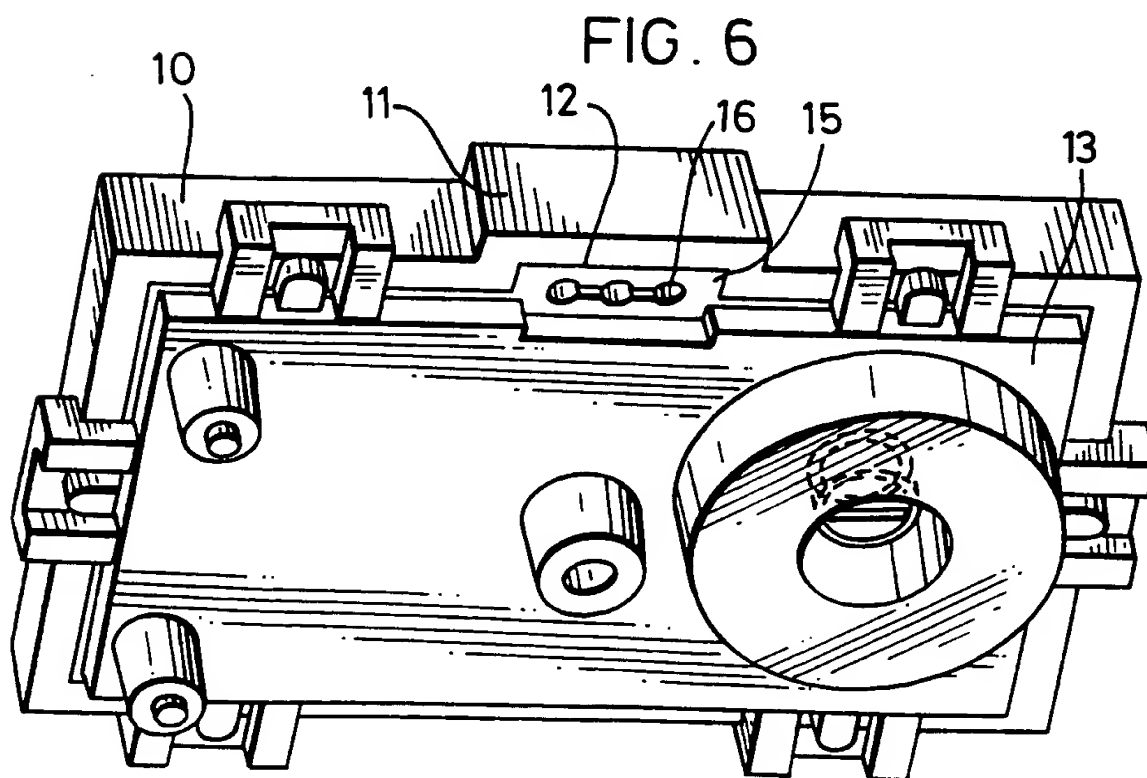
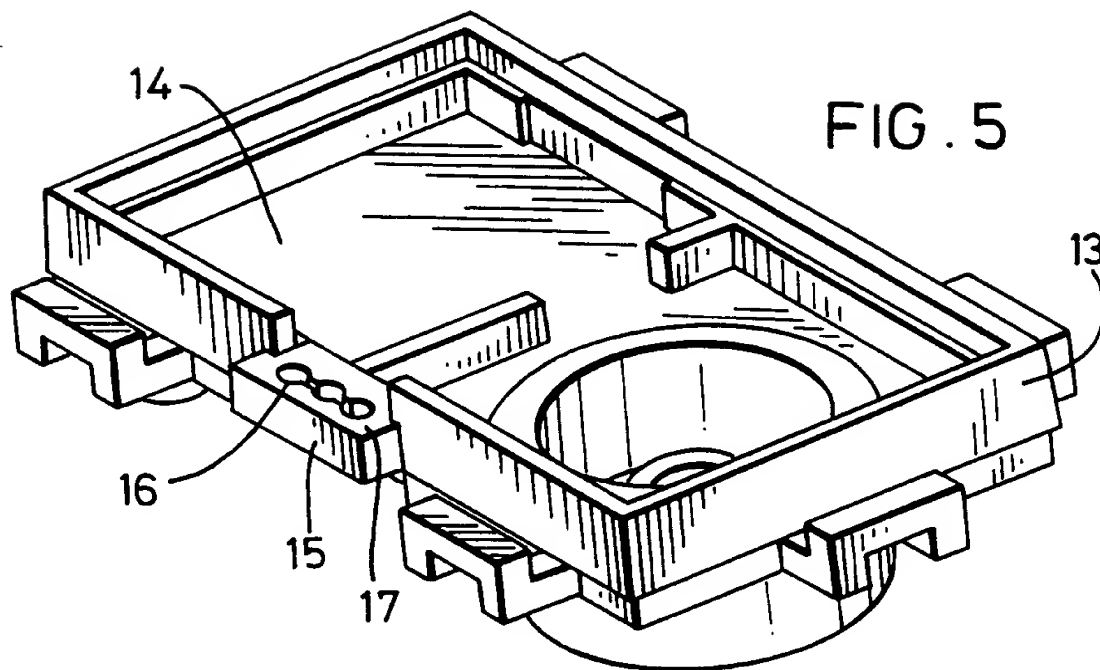




2/3



3 / 3



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 97/01513

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H05K9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 0 219 639 A (BOSCH GMBH ROBERT) 29 April 1987 see the whole document	1-4,6-8, 10,11 5,9, 12-14
X Y	DE 35 15 910 A (BOSCH GMBH ROBERT) 6 November 1986	1-4,6-8, 10,11 5,9, 12-14
A	EP 0 618 763 A (SIEMENS AG) 5 October 1994 see the whole document	1-14
A	US 5 510 574 A (WU PETER) 23 April 1996 see the whole document	1-14
A	US 5 180 314 A (GELIN CLAUDE ET AL) 19 January 1993	1-14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

26 September 1997

Date of mailing of the international search report

22. 10. 97

Name and mailing address of the ISA  
European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 851 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Torti, C

## PATENT COOPERATION TREATY

PCT

REC'D 27 AUG 1998

WIPO

PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P31659WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (PCT/IPEA/416)	
International application No. PCT/GB97/01513	International filing date (day/month/year) 04/06/1997	Priority date (day/month/year) 04/06/1996
International Patent Classification (IPC) or national classification and IPC H05K9/00		
Applicant PYRONIX LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 16/12/1997	Date of completion of this report 25. 08. 98
Name and mailing address of the IPEA/   European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Authorized officer  Torti, C  Telephone No. (+49-89) 2399-2495 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB97/01513

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

3-7,9,10,12-14 as originally filed

1,2,2a,8,11 as received on 27/06/1998 with letter of 23/06/1998

**Claims, No.:**

1-10 as received on 27/06/1998 with letter of 23/06/1998

**Drawings, sheets:**

1/3-3/3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB97/01513

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims 1-10
	No: Claims
Inventive step (IS)	Yes: Claims 1-10
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-10
	No: Claims

**2. Citations and explanations**

**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Concerning part V**

- 1) Claim 1 relates to an "enclosure for an electronic device (...) for suppressing emissions from a connection means"; claim 10 relates to an "intruder detection device" equipped with an enclosure as claimed in claim 1 and is regarded as an application of the enclosure according to the present invention.

Circuits are often housed in enclosures to prevent unwanted emissions radiating into free space; in particular, many attempts have been made in the art to prevent emissions at cable entry points or at contact points.

For example, document DE-A-3 515 910 (D1), discloses an enclosure comprising a chamber for accommodating an extension suitable for an external connection.

The enclosure of the present invention differs from the enclosure according to D1 in that it comprises a first frame portion comprising a recess and a main part comprising a projection, said projection being arranged to cooperate snugly with an open aspect of the recess to form an electromagnetically sealed extension chamber for housing the connection means extending from the board housed in the enclosure.

This particular assembly of the enclosure allows to obtain an improved protection of the connection means with a corresponding further reduction of the unwanted emissions.

None of the available documents suggests or renders obvious an assembly as claimed so that it is considered that the person skilled in the art, starting from the enclosure of D1, would not obviously arrive to the claimed enclosure on the basis of the available documents.

An inventive step, therefore, can be recognized.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB97/01513

**Concerning part VIII**

The amendments filed with the International Bureau under Article 19(1) introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 19(2) PCT.

In fact, according to the amended claim 1, filed with letter of 23.06.98, either the "first main enclosure portion" or the "second part" of the enclosure comprise a projection (15).

However, according to the description as originally filed said projection belongs to the part (13), see fig. 5 and page 10, lines 6-14, whilst no examples are given in which said projection is formed on the first frame portion (10).

It results that subject-matter has been introduced which extends beyond the content of the application as filed, contrary to Art. 19(2) PCT.

Moreover, the claims are not clear as a whole, Art. 6 PCT.

In fact, whilst in claim 1 a "first main enclosure portion" and a "second part" are claimed, claims 2-4 refer to a "frame portion" which is not previously defined in claim 1 so that a lack of clarity arises, Art. 6 PCT.

The opinion in the § "concerning part V", therefore, has been pointed out on the basis of a new set of claims amended so as to overcome the objections raised above. In particular, the new claim 1, starting from line 7 should read as follows:

enclosure being characterized by a first frame  
portion (10) having an outer wall (10A)  
comprising a recess (12) and  
a second main part (13) comprising a projection (15) arranged to cooperate  
snugly  
with an open aspect of the recess (12) to form  
an electromagnetically sealed extension chamber  
for housing the connection means (8),



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB97/01513

said projection (15) having  
at least one aperture (16) to receive a cable  
for connection to the connection means (8).

Accordingly, in claims 2-4 and 6 the expression "enclosure portion" has been substituted with the expression "part" whilst claim 5 should be excised since the subject-matter claimed therein is already claimed in claim 1.

ELECTRONIC DEVICE

This invention relates to an electronic device having an enclosure for electronic circuits for the suppression of spurious unwanted emissions such as harmonic emissions from electronic circuit components and discontinuities and, more particularly, to enclosures for suppressing or substantially reducing the emission of unwanted electromagnetic radiation whilst concurrently allowing the emission of wanted electromagnetic radiation.

Electronic circuits, and in particular microwave circuits, are used in a variety of applications, for example, they are commonly employed in motion detection units for detecting a moving person or object by means of a Doppler frequency shift. A motion detector is arranged to emit electromagnetic radiation at particular frequencies via a given aperture, that is to say, a motion detector is an intentional radiator of electromagnetic radiation.

All electronic circuits generate and radiate spurious emissions which can exceed a maximum level set by current EMC regulations. In order to conform to current EMC standards, any spurious emissions from circuit components and discontinuities having frequencies which fall outside an allocated frequency band must be

suppressed. Circuit elements or devices, for example, dielectric resonator oscillators and mixers, which are typically used in motion detection units, can generate significant levels of harmonic emissions. These  
5 emissions can leak out through the mechanical joints between, for example, the enclosure and the circuit board of the microwave motion detection unit.

DE-3 515 910 discloses an enclosure for a high frequency  
10 electronic circuit. The electronic circuit has an extension to which an external connection can be made. The enclosure comprises a chamber which accommodates the extension for suppressing electromagnetic emissions therefrom.

15

Circuits are therefore often housed in enclosures which act as shields to prevent unwanted emissions radiating into free space.

20 These enclosures are usually made of a conducting material such as aluminium or brass, or metal coated plastic. A conducting mesh can also be used providing that the apertures in the mesh are small enough to prevent the emissions from escaping. Enclosures can also  
25 be made of an absorbing material to absorb the emissions. Alternatively, a plastic material loaded with metal filings or granules can be used to confine emissions to the enclosure.

AMENDED SHEET

2a

High frequency emissions are more difficult to screen because they can escape through small gaps in the enclosure, for example, where the cover and the main enclosure joins, or at cable entry points.

AMENDED SHEET

Figure 5 illustrates a perspective view of a main enclosure for an electronic circuit, seen from above.

Figure 6 illustrates a perspective view of an electronic circuit, in this case a motion detector assembly, when fully assembled, seen from below.

Referring to figure 2, there is shown a frame 10 or first portion of an enclosure made of a electrically conductive material and having a continuous or integrally formed outer wall 10a. The enclosure is arranged to accommodate a circuit board bearing elements capable of generating undesired electromagnetic radiation. The outer wall 10a comprises an extension 11 for housing a circuit element which extends from said circuit board.

Referring now to figure 3, there is shown schematically a perspective view of the first portion view from below. It can be seen that extension 11 comprises a recess 12 in order to accommodate an extending connection means, for example, solder tabs or the like (not shown).

Figure 4 depicts a printed circuit board assembly 2 comprising a microwave circuit board 2c and having connection means in the form of a solder tab 8 extending outwardly from the periphery of the microwave circuit board 2c. An antenna circuit board 2a having an antenna

located to prevent emission of em-radiation from within the chamber. The only access to solder tab 8 is via aperture 16 through which a ribbon cable, for example, can be located. The cable is a close, push fit within  
5 the spaced circular holes which form aperture 16. The holes can be cylindrical or tapered to ease insertion of the cable.

The printed circuit board 2 with groundplane facing  
10 outwards, is mounted in the main enclosure 13 and held in place by frame 10. The frame and the main enclosure in the vicinity of the solder tab, ie projection 15 and extension 11, are a close fit to substantially obviate or reduce emissions escaping through the joint. The solder  
15 tab is now completely enclosed in a chamber formed by the frame and the main enclosure.

Although there is still a path through the cable insulation, ie the outer part of the ribbon cable, by  
20 which emissions can escape, the actual gap between the cable conductor, ie the central part of the cable, and the enclosure is as a consequence of the snug fit smaller and hence unwanted emissions are significantly reduced.

25 It will be apparent to those skilled in the art from the information contained herein that the principle of shaping the aperture in the wall of an enclosure to minimise gaps through which cables pass, can be applied

CLAIMS

1. An enclosure (10, 13) for an electronic device having an electronic circuit board (2) for  
5 suppressing emissions from a connection means (8) extending from the electronic circuit board (2), the enclosure being characterised by a first main enclosure portion (10) having an outer wall (10A) comprising a recess (12), and  
10 a second part (13) arranged to cooperate snugly with an open aspect of the recess (12) to form an electromagnetically sealed extension chamber for housing the connection means (8), at least one of either the first portion (10) or second  
15 part (13) comprising a projection (15) having at least one aperture (16) to receive a cable (9) for connection to the connection means (8).
2. An enclosure as claimed in claim 1, wherein at least  
20 one of either the frame portion and the main enclosure portion is electromagnetically continuous and is preferably integrally formed.
3. An enclosure as claimed in any preceding claim,  
25 wherein at least one of either the frame portion and the main enclosure portion comprise electromagnetic radiation absorbent and/or reflective material.

4. An enclosure according to any preceding claim,  
wherein the frame portion is conductive.
5. An enclosure as claimed in any preceding claim,  
5 wherein the first main enclosure portion comprises  
a projection having one or more apertures through  
which connection to the connection means can be  
made.
- 10 6. An enclosure as claimed in any preceding claim,  
wherein the first main enclosure portion is  
conductive.
- 15 7. An enclosure as claimed in any preceding claim,  
wherein the connection means is adapted for  
connection to a cable, power source, antenna feed or  
the like.
- 20 8. An enclosure as claimed in any preceding claims,  
wherein the connection means comprises at least one  
solder tab.
9. An enclosure as claimed in any preceding claim,  
wherein the electronic circuit board is operable at  
25 least one of either RF or microwave frequencies.
10. A intruder detection device, preferable a motion  
detector, for intentionally radiating



electromagnetic radiation of a selectable frequency,  
said motion detector comprising an enclosure  
according to any preceding claim for suppressing  
frequencies other than said selectable frequency.

5

AMENDED SHEET

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>P31659W0</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 97/ 01513</b>	International filing date (day/month/year) <b>04/06/1997</b>	(Earliest) Priority Date (day/month/year) <b>04/06/1996</b>
Applicant <b>PYRONIX LIMITED et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (see Box I).
2. ☐ Unity of invention is lacking (see Box II).
3. ☐ The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
- ☐ filed with the international application.
  - ☐ furnished by the applicant separately from the international application,
    - ☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
  - ☐ Transcribed by this Authority

4. With regard to the title, ☐ the text is approved as submitted by the applicant.  
☒ the text has been established by this Authority to read as follows:

**ELECTRONIC DEVICE WITH A SHIELDING ENCLOSURE**

5. With regard to the abstract,
- ☒ the text is approved as submitted by the applicant.
  - ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:

Figure No. 6 ☒ as suggested by the applicant.  
☐ because the applicant failed to suggest a figure.  
☐ because this figure better characterizes the invention.

☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

National Application No

PCT/GB 97/01513

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H05K9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 219 639 A (BOSCH GMBH ROBERT) 29 April 1987	1-4, 6-8, 10, 11
Y	see the whole document	5, 9, 12-14
	---	
X	DE 35 15 910 A (BOSCH GMBH ROBERT) 6 November 1986	1-4, 6-8, 10, 11
Y		5, 9, 12-14
	---	
A	EP 0 618 763 A (SIEMENS AG) 5 October 1994 see the whole document	1-14
	---	
A	US 5 510 574 A (WU PETER) 23 April 1996 see the whole document	1-14
	---	
A	US 5 180 314 A (GELIN CLAUDE ET AL) 19 January 1993	1-14
	-----	

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*&\* document member of the same patent family

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Torti, C

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 97/01513

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0219639 A	29-04-87	DE 3537669 A DE 3681683 A	23-04-87 31-10-91
DE 3515910 A	06-11-86	NONE	
EP 0618763 A	05-10-94	DE 9304825 U DE 59400028 D	05-05-94 16-11-95
US 5510574 A	23-04-96	NONE	
US 5180314 A	19-01-93	FR 2666695 A DE 69104940 D DE 69104940 T EP 0474184 A ES 2066298 T IE 65743 B JP 4272673 A	13-03-92 08-12-94 23-03-95 11-03-92 01-03-95 15-11-95 29-09-92